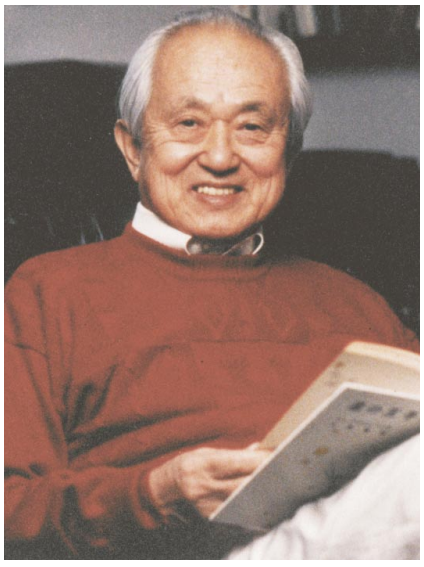


MINORU ODA

laboratories. In 1984, Oda became ISAS's director general. Among the projects he promoted was VSOP, the VLBI (Very Long Baseline Interferometry) space observatory program. The acronym VSOP (also a type of cognac) suggests the many well-lubricated occasions enjoyed by Oda and his colleagues as one after another of their satellites was launched, on schedule and within budget.

On retirement from ISAS in 1988, Oda was appointed president of the Institute of Physical and Chemical Research (RIKEN), an organization in Wako, Japan, with more than 2000 people in more than 50 research areas, from particle physics to genome science. Oda widened international collaborations, stimulated new programs in high-energy astronomy and brain research and established the RIKEN advisory council, similar to the visiting committees of many US and European institutions but rarely used in Japan. Following a five-year term at RIKEN, Oda became director of the International Institute for Advanced Studies for two years, and president of the Tokyo University of Information Sciences until his death.

As scientist, administrator, and adviser to the Japanese government, Oda was esteemed for his wisdom and fairness, his sure sense of scientific strategy, his ability to marshal the resources for large projects, and his generosity in promoting the careers of his students and associates.

Among Oda's many honors are the Nishina Memorial Prize (1967), the most prestigious physics prize in Japan, given by the Nishina Memorial Foundation; the Japan Academy Award (1975); and Japan's Order of Cultural Merit (1993). He also was awarded the First Class Order of the Sacred Treasure, presented by the Japanese emperor, and the 1996 COSPAR Space Science Award from the Committee on Space Research (COSPAR) of the International Council for Science.

Away from his duties he was a member of the Mozart Society of Tokyo and the Japan Alpine Club. He and his wife Tomoe often stopped on their travels at a favorite chalet in the Swiss Alps where they would hike, enjoy fine wines, and eat well. She would gather wildflowers of which he would make exquisite drawings and watercolor paintings.

GEORGE CLARK
Massachusetts Institute of Technology
Cambridge
FUMIAKI NAGASE
Institute of Space and Astronautical Science
Sagamihara, Japan
JOHN LINSLEY
University of New Mexico
Albuquerque

Harry Brumberger

Harry Brumberger, professor emeritus of chemistry at Syracuse University and a pioneer in the field of small-angle x-ray scattering, died on 10 November 2000, in a Syracuse hospital, where he had been admitted for implantation of a pacemaker.

Harry was born on 28 August 1926 in Vienna, Austria. As a young teenager, he came to the US with his parents to flee anti-Semitic persecution. He held great affection for pre-1930s Austria, particularly Vienna, and talked often of the city's vibrant cultural and intellectual life. However, he spoke very little of the experiences in Austria that prompted his family to leave the country.

Harry served in the US Army in the ski troops. He then attended the Brooklyn Polytechnic Institute in New York City, where he earned his degrees in chemistry: BS in 1949, MS in 1952, and PhD in 1955. He also studied at the Swiss Federal Institute of Technology (ETH) in Zürich. Harry's doctorate was directed by Rudolph Marcus, who later won a Nobel Prize in Chemistry. Harry was the first student to complete a doctorate under Marcus's direction, and his thesis involved kinetic studies on the reaction of diborane with amines; reaction rates were determined experimentally. In 1955, he began his postdoc with another Nobel prizewinner, Peter Debye, at Cornell University.

HARRY BRUMBERGER

Harry joined the Syracuse University chemistry department in 1957 as an assistant professor; he became an associate professor in 1962 and a professor in 1969. He was also a visiting scholar at the University of Graz in Austria, National Bureau of Standards, Weizmann Institute of Science in Israel, University of Cambridge in the UK, and ETH. In addition, he was a Fulbright grantee in India. Between 1969 and 1985 at Syracuse, he served as director of both the graduate biophysics program and the solid-state science and technology program.

Harry's research on small-angle x-ray scattering began at Cornell and continued at Syracuse. In the early days (from about 1955 to 1975), the available x-ray sources were of very low intensity and the detectors were primitive. Precise alignment and angular measurements were required. Harry, who carried out meticulous experimental measurements and took great care in interpreting results, quickly became an internationally recognized expert in the field.

Between 1957 and 1965, Harry helped to develop both the theoretical structure and the experimental procedure for the application of small-angle x-ray scattering to a variety of systems. He showed how, from the relatively featureless scattering curves, one could obtain particle sizes and interphase surface areas. Subsequently (1964–81), he carried out such measurements on alloys, glasses, polymers, DNA, proteins, thin films, multiphase systems, and solutions near their critical points. Among the multiphase systems, supported-metal heterogeneous catalysts were of particular interest. Then as now,

knowing the interphase surface areas and how they change during catalyst preparation and use is extremely important.

A desire for conciseness and clarity informed Harry's teaching. He took whatever time was needed to explain a difficult point to a student or colleague. Although his talents for deflating pomposity and signaling unclear thinking in others did not endear him to everyone, his teaching and advising were appreciated by his students. Furthermore, colleagues worldwide sought his advice on scientific and other matters. Correspondence from Harry was a great pleasure to read, both because of the elegance of the writing style and the intelligent content. An often-invited speaker at international conferences, he remained active as a member-at-large of the small-angle scattering special interest group of the American Crystallographic Association.

His last research project involved small-angle scattering measurements on metal-zeolite systems, performed at the Cornell High Energy Synchrotron Source in 1999. The intensity of the source permits measurement of an entire scattering curve in seconds or minutes. This measurement allowed Harry to study the changes when a zeolite, impregnated with a platinum–ammonia compound, is exposed to reducing and oxidizing atmospheres in turn for several minutes at a time, as happens in catalyst preparation. In 1996, he established that sintering of metal particles (which should be avoided because it decreases surface area) occurred during calcination (oxidizing atmosphere), but could be minimized if the calcination was performed slowly at temperatures low enough for the ammonia to be lost without decomposition.

Harry retired from the chemistry department at Syracuse in 1995. However, he remained active in research, which he did on small-angle x-ray scattering from solid catalysts. In April 1996, Syracuse awarded him the title of research professor in chemistry. He continued to teach at the university and at SUNY's environmental science and forestry college, located in Syracuse. One month before his death, he was involved in the planning for a colloid chemistry course, which he loved to teach, at Syracuse.

Harry was a gentleman and a scientist. A truly educated and learned man, he was widely read and often impressed others by his knowledge. He was particularly interested in history. In the months before his death, he studied Latin so that he could study some of the alchemical texts in the original language.

A few weeks before Harry's death, a reporter for a Syracuse newspaper interviewed him for a story about the Cornell synchrotron. Harry told him about the joys of scientific research and how they justified all the hardships, such as all-nighters when beam time was available. He spoke of the "fascination about it" and ended with "I have pages and pages of . . . experiments we would like to do."

Harry's devotion to his research is one of the things we will long remember. We will miss his elegance, wit, and erudition, qualities that made him a great colleague and friend whose absence saddens us.

JERRY GOODISMAN
Syracuse University
Syracuse, New York
SALVINO CICCARIELLO
University of Padua
Padua, Italy
GERNOT KOSTORZ
Swiss Federal Institute of Technology (ETH) Hönggerberg
Zürich, Switzerland

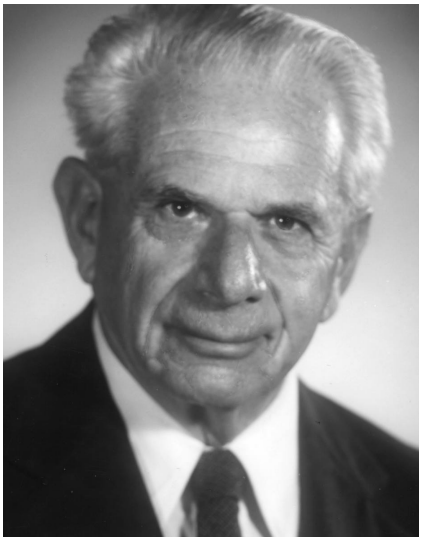
Arnold Boris Arons

Arnold Boris Arons, an internationally recognized pioneer and leader in physics education and a professor emeritus of physics at the University of Washington, died suddenly of a heart attack at his home in Seattle on 28 February 2001.

Born on 23 November 1916 in Lincoln, Nebraska, Arnold grew up in New Jersey and received an ME degree in 1937 and an MS in chemistry in 1940, both from the Stevens Institute of Technology. He obtained his PhD in physical chemistry in 1943 from Harvard University, where he worked with E. Bright Wilson Jr on a study of shock waves produced by underwater explosions.

During World War II, Arnold was a group leader in the Underwater Explosion Research Laboratory at the Woods Hole Oceanographic Institution, beginning an association with Woods Hole that lasted throughout his lifetime. He was well known for his studies of abyssal oceanic circulation and cloud physics with Henry M. Stommel and Alfred H. Woodcock and for experimental and theoretical work on phase distortion of acoustic pulses reflected from the seabed.

In 1946, Arnold accepted a position as an assistant professor of physics at the Stevens Institute of Technology. He remained there until 1952, when



ARNOLD BORIS ARONS

he moved to Amherst College as a professor of physics. At Amherst, Arnold was widely known as a skilled teacher and was one of the subjects of a *Time* magazine cover story on education (6 May 1966). Recognizing the inadequacies of traditional physics instruction at the time, Arnold developed a calculus-based introductory course as the science component of a core curriculum required of all freshmen. Through his teaching, he brought to the course historical, philosophical, and humanistic perspectives. His first textbook, *Development of Concepts of Physics* (Addison-Wesley, 1965), grew out of this experience.

In 1968, Arnold was invited to join the faculty at the University of Washington, where he initiated an introductory physical sciences course for preservice elementary school teachers. From 1969 to 1975, he directed NSF summer institutes for in-service elementary school teachers. During this period, the program was expanded to include teachers of high-school physics. The work with teachers led to the establishment of the Physics Education Group at the University of Washington, widely known for its role in teacher education and its leadership in the field of physics education research. After his retirement in 1982, Arnold continued to lecture, conduct workshops, and write extensively on the teaching of physics.

Throughout his career, Arnold reflected on the intellectual challenges involved in learning physics, and he set exceptionally high standards for himself and his colleagues. He played a unique role in raising awareness that introductory physics courses are often ineffective in helping students develop conceptual